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LISTS OF SPECIES

Baetidae (Insecta: Ephemeroptera) from northeastern Brazil

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ABSTRACT: New records and notes on the distribution of the family Baetidae are presented. The following genera are reported for this region: *Americabaetis*, *Apobaetis*, *Aturbina*, *Baetodes*, *Callibaetis*, *Camelobaetidius*, *Cloeodes*, *Cryptonympha*, *Guajirolus*, *Paracloeodes*, *Rivudiva*, *Spiritiops*, *Waltzoyphius* and *Zelusia*. With the results of the present study, the Northeast Region of Brazil ceases to be one of Brazil's five geographic regions with the least-known Baetidae fauna to become the region with the second highest number of known species in the family, increasing the number from 15 to 36 species.

INTRODUCTION

Baetidae is considered to be the largest family in number of Ephemeroptera species, with 97 genera distributed worldwide. This family is represented by approximately 830 species, with the largest number of species being reported in the Neotropical region (Baber-James *et al*. 2008). Brazil has 72 species of Baetidae, most of which (38) are recorded from the Southeast Region. The Northeast Region is one of the least-sampled regions in Brazil, and consequently it has only incipient taxonomic knowledge on Ephemeroptera when compared to the South and Southeast regions (Lima *et al*. 2010). Currently 15 species are recorded from the Northeast Region, 12 of these have been reported in a recently published paper from the state of Bahia (Lima *et al*. 2010).

This study aims to present new records and distributional notes for the family in the Northeastern Region, as well as a list of all known Baetidae species from this region.

MATERIALS AND METHODS

Collection was done between July and August 2010, and May, June and September 2011, in five states in the Northeastern Region of Brazil: Maranhão, Piauí, Ceará, Bahia and Rio Grande do Norte. Additionally, samples collected in Goiás state, located in the Central-West Region of Brazil, were included because the sampled area is located near the border with Bahia state (Figure 1). Data pertaining to each sample site are provide in Table 1.

Nymphs were collected with an aquatic entomological net. Additionally, adults were captured with light traps. Collected specimens were fixed in 80% ethanol. Permanent slides, when needed, were made using Euparal® as the mounting medium. The identifications were based on Salles and Serrão (2005), Domínguez *et al*. (2006), Emmerich and Nieto (2009) and other relevant papers for each taxon (*e.g.* Salles 2007; Salles and Francischetti 2004).

Examined specimens are deposited in the following institutions: Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil and Zoological Collection of the Centro Universitário Norte do Espírito Santo (CEUNES), São Mateus, Espírito Santo, Brazil.

The symbol "P" refers to the collection site, listed in Table 1; "Ep" means catalogue number of the CEUNES; "I" and "N" mean "imago" and "nymph", respectively.

RESULTS AND DISCUSSION

Our study records 14 species and five genera for the first time from northeastern Brazil, bringing the total for this region to 36 species and 14 genera, all listed in a Table 2. Two species of *Baetodes* were not possible to identify. They probably represent undescribed species.

With the results of the present study, the Northeast Region of Brazil ceases to be one of the regions with the least-known Baetidae fauna to become the region with the second highest number of known species in the family. The updated list of Brazilian regions in decreasing order of number of Baetidae species recorded is: Southeast, with 38 species and 15 genera; Northeast, with 36 and 14; North, with 23 and 14; Central-West, with 19 and 13; and South Region, with 17 and 13 (Salles *et al*. 2011).

Our sampling area included only five of the nine states of the region and a small number of streams and rivers that were sparsely distributed. Certainly, an increase in the sampling area and collection effort would greatly increase knowledge of the aquatic insects in northeastern Brazil.

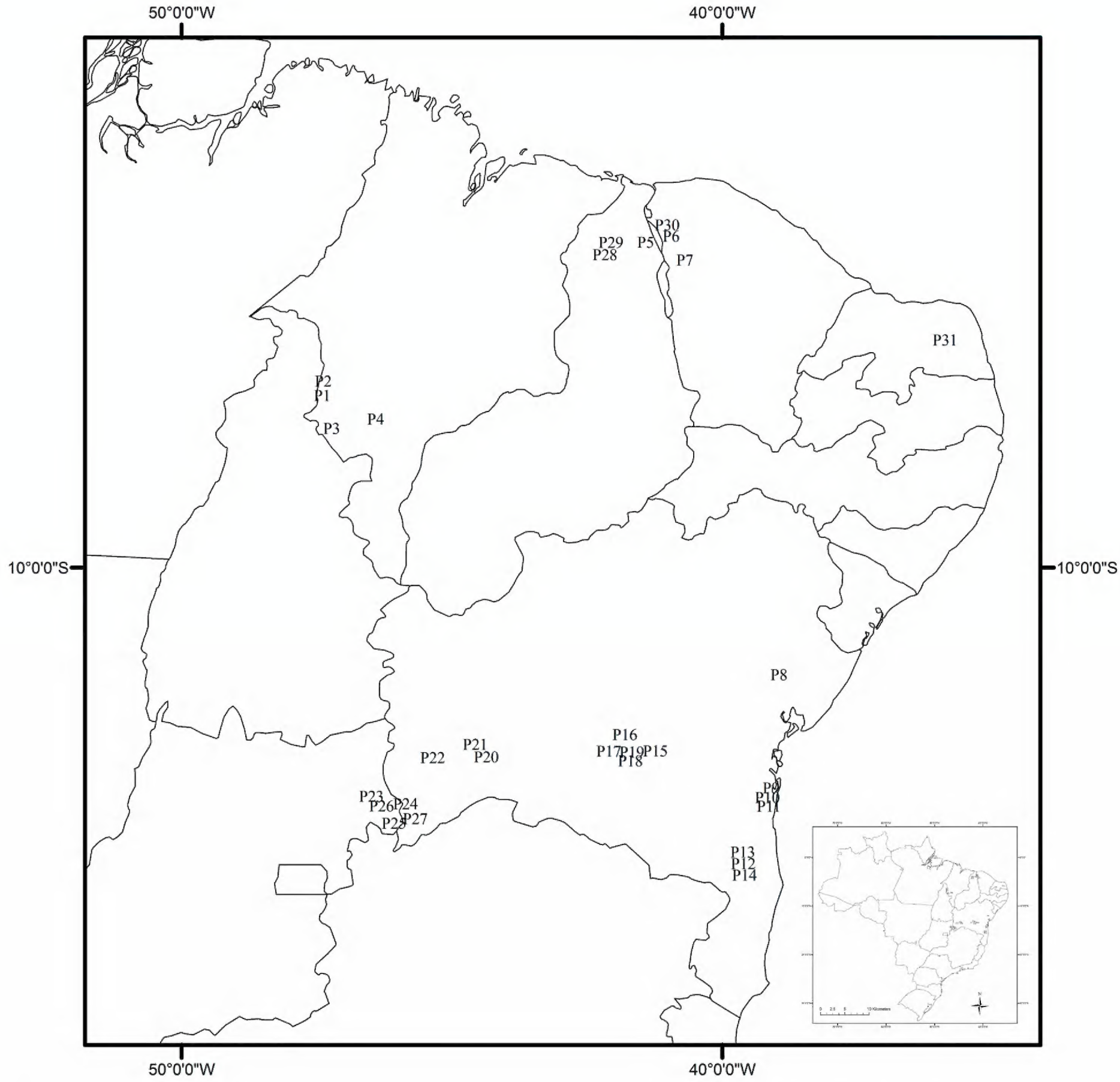

FIGURE 1. Sampling sites in the northeastern region where Baetidae (Insecta: Ephemeroptera) species were collected.

TABLE 1. Sample sites at northeastern Brazil and border with Goiás state, followed by site, location, date, geographic coordinates, and collectors.

SITE	LOCATION	DATE	COORDINATES	COLLECTORS
P1	Maranhão, Rio Lajeado, BR010, below the bridge	21.vii.2010	06°41'05.0" S, 47°22'56.6" W	Boldrini, R., Cruz, P.V. and Hamada, N.
P2	Maranhão, Rio Farinha, BR010, near the bridge	22.vii.2010	06°31'47.3" S, 47°28'11.4" W	Boldrini, R., Cruz, P.V. and Hamada, N.
P3	Maranhão, Rio Itapecuru, disabled hydroelectric	22.vii.2010	07°24'53.2" S, 47°12'54.9" W	Boldrini, R., Cruz, P.V. and Hamada, N.
P4	Maranhão, Riachão, Riacho Cocal, Cachoeira Santa Barbara	23.vii.2010	07°13'46" S, 46°27'24" W	Boldrini, R., Cruz, P.V. and Hamada, N.
P5	Piauí, São João da Fronteira, Rio Jenipapo, below the bridge	26.vii.2010	04°00'15.8" S, 41°26'53.8" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.
P6	Ceará, Ubajara, Distrito da Cachoeira do Boi morto, Rio Jaburu	26.vii.2010	03°52'36.2" S, 41°0.1'00.8" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.
P7	Ceará, Município de Ipu, Bica de Ipu	27.vii.2010	4°19'01.2" S, 40°43'33.6" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.
P8	Bahia, Tanquinho, Morro Branco, river that cuts the road	30.vii.2010	12°00'21.1" S, 39°0.6'07.2" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.
P9	Bahia, Itacaré, Cachoeira do Tremembé	31.vii.2010	14°0.9'00.6" S, 39°0.5'32.8" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.
P10	Bahia, Maraú, Rio Santa Maria	31.vii.2010	14°11'12.4" S, 39°05'34.7" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.

TABLE 1. ***CONTINUED.***

SITE	LOCATION	DATE	COORDINATES	COLLECTORS
P11	Bahia, Itacaré, Fonte Tulipa negra, tributary of the Tijuípe River	31.vii.2010	14°24'27.2" S, 39°03'13.5" W	Boldrini, R., Cruz, P.V., Querino, R. and Hamada, N.
P12	Bahia, Camacam, Rio Panelão, near the base of the Serra Bonita	02.viii.2010	15°24'24.9" S, 15°24'24.9" W	Boldrini, R., Querino, R. and Hamada, N.
P13	Bahia, Camacam, Reserva Serra Bonita, Riacho na RPPN Serra Bonita	02.viii.2010	15°22'59.1" S, 39°33'21.2" W	Boldrini, R., Querino, R. and Hamada, N.
P14	Bahia, Reserva Serra Bonita, Riacho na RPPN Serra Bonita, near the junction for tower and hostel	02.viii.2010	15°23'03.4" S, 39°34'11.3" W	Boldrini, R., Querino, R. and Hamada, N.
P15	Bahia, Ibicoara, Balneário do Otton	03.viii.2010	13°26'02.7" S, 41°15'43.9" W	Boldrini, R., Querino, R. and Hamada, N.
P16	Bahia, Rio de Contas, Pico do Itobira, Rio Comburú	04.viii.2010	13°22'55.7" S, 41°53'39.9" W	Boldrini, R., Querino, R. and Hamada, N.
P17	Bahia, Rio de Contas, river that cuts the road to Pico do Itobira	04.viii.2010	13°24'19.1" S, 41°52'53.9" W	Boldrini, R., Querino, R. and Hamada, N.
P18	Bahia, Rio de Contas, river on the road, the road to Mato Grosso	04.viii.2010	13°28'55.1" S, 41°51'54.7" W	Boldrini, R., Querino, R. and Hamada, N.
P19	Bahia, Piatã, source of the Rio de Contas	05.viii.2010	13°07'23.6" S, 41°50'14.1" W	Boldrini, R., Querino, R. and Hamada, N.
P20	Bahia, Correntina, Serragem, Rio Arrojado	07.viii.2010	13°26'48.5" S, 44°33'10.3" W	Boldrini, R., Querino, R. and Hamada, N.
P21	Bahia, Rio Correntina (near the restaurant)	07.viii.2010	13°19'59.6" S, 44°36'08" W	Boldrini, R., Querino, R. and Hamada, N.
P22	Bahia, Correntina, Rio Correntina, Cachoeira	08.viii.2010	13°31'09.6" S, 45°21'01.8" W	Boldrini, R., Querino, R. and Hamada, N.
P23	Goiás, Posse, Rio do Prata, Lagoa, Road to na Rosário to Posse, border between Bahia and Goiás	09.viii.2010	14°14'46.4" S, 46°33'07.0" W	Boldrini, R., Querino, R. and Hamada, N.
P24	Goiás, Mambaí, River near Mambaí	10.viii.2010	14°28'36.0" S, 46°07'03.0" W	Boldrini, R., Querino, R. and Hamada, N.
P25	Goiás, Mambaí, Sítio de Abadia, marsh on the road	10.viii.2010	14°45'53.7" S, 46°14'11.9" W	Boldrini, R., Querino, R. and Hamada, N.
P26	Goiás, Mambaí, Rio Vermelho, Rio Vermelho Canyon, Rio das Dores (Rio Vermelho tributary)	10.viii.2010	14°26'21.0" S, 46°13'41.0" W	Boldrini, R., Querino, R. and Hamada, N.
P27	Bahia, Cocôs, Rio Formoso	11.viii.2010	14°40'00.6" S, 45°49'32.3" W	Boldrini, R., Querino, R. and Hamada, N.
P28	Piauí, Barras, Rio Longa, near the bridge	27-28.v.2011	04°12'19.9" S, 42°14'10.6" W	Cruz, P.V., Querino, R. and Hamada, N.
P29	Piauí, Batalha	28.v.2011	04°01' S, 42°05' W	Cruz, P.V., Querino, R. and Hamada, N.
P30	Ceará, Tianguá, Viçosa, Road to Tianguá	03.vi.2011	03°42'44.2" S, 41°03'25.3" W	Cruz, P.V., Querino, R. and Hamada, N.
P31	Rio Grande do Norte, Parnamirim, Farm EMPARN	09.ix.2011	05°50' S, 36°15' W	Boldrini, R., Ottoni, B.M.P. and Andreazze, R.

FIGURES 2-5. Baetidae nymphs, dorsal view. 2, *Americabaetis alphus*; 3, *A. longetron;* 4, *A. fiuzai*; 5, *Callibaetis pollens.*

Figures 6-12. Baetidae nymphs, dorsal view. 6, *Camelobaetidius cayumba*; 7, *C. janae;* 8, *C. lassance*; 9, *C. tuberosus*; 10, *Cryptonympha copiosa*; 11, *Paracloeodes binodulus*; 12, *P. waimiri*.

Figures 13-15. Baetidae nymphs, dorsal view. 13, *Rivudiva trichobasis*; 14, *Spiritiops silvudus*; 15, *Waltzoyphius fasciatus*.

Table 2. List of species of Baetidae from northeast Brazil.

SPECIES	DISTRIBUTION	MATERIAL EXAMINED
***Americabaetis alphus* Lugo-Ortiz and McCafferty** (Figure 2)	Argentina, Bolivia, Chile, Paraguay, Brazil: Minas Gerais, Paraná, Santa Catarina, Rio Grande do Sul (Lugo-Ortiz and McCafferty 1996a); Rio de Janeiro (Francischetti *et al.* 2003); São Paulo (Salles *et al.* 2003); Mato Grosso (Salles *et al.* 2004b); Bahia (Lima *et al.* 2010); Espírito Santo (Salles *et al.* 2010a); Alagoas, Amazonas, Pernambuco, Sergipe, Goiás (Salles *et al.* 2010b). **New Records**: Piauí, Ceará	P5 (Ep-2228 – 3N); P12 (Ep-2229 – 5N); P22 (Ep-2230 – 5N); P24 (Ep-2231 – 4N); P26 (Ep-2232 – 5N) - CEUNES; P27 (4N) - INPA
***Americabaetis labiosus* Lugo-Ortiz and McCafferty**	Paraguay, Uruguay, Brazil: Rio Grande do Sul, Paraná, Santa Catarina (Lugo-Ortiz and McCafferty 1996a); Rio de Janeiro (Francischetti *et al.* 2003); São Paulo (Salles *et al.* 2003); Espírito Santo (Salles *et al.* 2010a); Minas Gerais (Salles *et al.* 2010b); Bahia (Lima *et al.* 2010)	
***Americabaetis longetron* Lugo-Ortiz and McCafferty** (Figure 3)	Uruguay, Paraguay, Brazil: Minas Gerais, Paraná, Santa Catarina (Lugo-Ortiz and McCafferty 1996a); Espírito Santo (Lugo-Ortiz *et al.* 2002; Rio de Janeiro (Francischetti *et al.* 2003); São Paulo (Salles *et al.* 2003). **New Records**: Goiás, Bahia	P12 (1N) - INPA; P24 (Ep-2233 – 5N) - CEUNES
***Apobaetis fiuzai* Salles and Lugo-Ortiz** (Figure 4)	Argentina (Nieto 2006); Brazil: Mato Grosso, Minas Gerais (Salles and Lugo-Ortiz 2002a); São Paulo (Salles *et al.* 2003); Rio de Janeiro (Salles *et al.* 2004a); Espírito Santo (Salles *et al.* 2010a); Amazonas (Cruz *et al.* 2011). **New Records**: Bahia, Maranhão	P2 (1N) - INPA; P18 (Ep-2234 – 1N) - CEUNES
***Aturbina beatrixae* Gillies**	Uruguay (Gillies, 2001); Argentina (Domínguez *et al.* 2006); Brazil: Santa Catarina, Paraná, São Paulo, Mato Grosso, Minas Gerais, Espírito Santo, Bahia (Salles *et al.* 2011)	P31 (4N) -INPA
***Aturbina georgei* Lugo-Ortiz and McCafferty**	French Guiana; Paraguay, Brazil: Acre, Amazonas, Mato Grosso, Pará (Lugo-Ortiz and McCafferty 1996b); Colombia (Domínguez *et al.* 2002); Espírito Santo (Salles *et al.* 2010a); Bahia (Lima *et al.* 2010)	
***Baetodes liviae* Polegatto and Salles**	Brazil: Paraná (Salles and Polegatto 2008). **New Records:** Bahia	P16 (1N) - INPA; P20 (Ep - 2235 – 1N) - CEUNES
***Baetodes* sp 1**	Brazil: Maranhão	P4 (3N) -INPA
***Baetodes* sp. 2**	Brazil: Bahia, Goiás	P22 (2N); P23 (4N) - INPA
***Callibaetis gonzalezi* (Navás)**	Argentina (Gillies 1990); Paraguay (Navás 1934); Brazil: Rondônia, Amazonas (Cruz *et al.* in press). **New Record**: Bahia	P10 (5N) - INPA
***Callibaetis pollens* Needham and Murphy** (Figure 5)	Argentina (Nieto 2008); Brazil: Mato Grosso do Sul (Needham and Murphy 1924). **New Records**: Ceará, Bahia, Goiás, Piauí, Maranhão	P1 (15N); P2 (1N); P4 (10N); P5 (10N); P6 (15N); P8 (10N); P17 (7N); P18 (1M/1F); P23 (15N); P27 (7N) - INPA

TABLE 2. ***CONTINUED.***

SPECIES	DISTRIBUTION	MATERIAL EXAMINED
Camelobaetidius billi **Thomas and Dominique**	Venezuela (Nieto *et al.* 2011); French Guiana (Dominique *et al.* 2001); Brazil: Amazonas (Salles and Dias 2004), Bahia (Lima *et al.* 2010), Espírito Santo (Salles *et al.* 2010)	P9 (4N); P12 (4N); P13 (1N); P14 (4N); P16 (4N); P18 (5N); P21 (2N) - INPA
Camelobaetidius cayumba **(Traver and Edmunds)** (Figure 6)	Colombia (Domínguez *et al.* 2002); Peru (Traver and Edmunds 1968); French Guiana (Thomas *et al.* 2003); Brazil: Rondônia, Goiás (Salles and Serrão 2005). **New Records**: Piauí, Maranhão, Ceará	P1 (Ep-2236 – 1N) - CEUNES; P5 (10N) - INPA; P29 (Ep-2237 – 1N); P30 (Ep-2238 – 1N) - CEUNES
Camelobaetidius francischettii **Salles, Andrade and Da-Silva**	Brazil: Alagoas, Rio de Janeiro (Salles *et al.* 2005); Espírito Santo (Boldrini and Salles 2009); Bahia (Lima *et al.* 2010)	
Camelobaetidius hamadae **Salles and Serrão**	Brazil: Bahia (Salles and Serrão 2005)	
Camelobaetidius janae **Dominique and Thomas** (Figure 7)	Venezuela (Nieto *et al.* 2011); French Guiana (Dominique *et al.* 2001); Brazil: Rondônia, Mato Grosso (Salles and Serrão 2005). **New Record**: Piauí	P28 (4N) - INPA; P29 (Ep-2239 – 2N) - CEUNES
Camelobaetidius lassance **Salles and Serrão** (Figure 8)	Brazil: Minas Gerais, São Paulo (Salles and Serrão 2005); Bahia (Lima *et al.* 2010)	P15 (4N) - INPA
Camelobaetidius maranhensis **Salles and Serrão**	Brazil: Maranhão (Salles and Serrão 2005)	P4 (5N) - INPA
Camelobaetidius rufiventris **Boldrini and Salles**	Brazil: Espírito Santo (Boldrini and Salles 2009); Bahia (Lima *et al.* 2010)	P9 (4N) - INPA
Camelobaetidius tuberosus **Lugo-Ortiz and McCafferty** (Figure 9)	Paraguay (Lugo-Ortiz and McCafferty 1999); Argentina (Nieto 2003); Brazil: Mato Grosso, Minas Gerais (Salles and Serrão 2005). **New Records**: Maranhão, Piauí, Ceará	P1 (24N); P2 (13N); P5 (8N) - INPA; P6 (Ep-2240 – 10N) - CEUNES
Cloeodes **cf.** ***opacus*** **Nieto and Richard**	Argentina (Nieto and Richard 2008); Uruguai (Nieto and Emmerich 2011); Brazil: Bahia (Lima *et al.* 2011)	
Cloeodes irvingi **Waltz and McCafferty**	Paraguay (Waltz and McCafferty 1987); Brazil: Espírito Santo (Lugo-Ortiz *et al.* 2002), São Paulo (Salles *et al.* 2003), Minas Gerais (Salles *et al.* 2004a). **New Records**: Ceará, Goiás	P7 (3N); P18 (8N) - INPA; P23 (Ep-2241 – 3N); P26 (Ep-2242 – 4N) - CEUNES
Cryptonympha copiosa **Lugo-Ortiz and McCafferty** (Figure 10)	Colombia (Domínguez *et al.* 2002); Venezuela (Nieto *et al.* 2011); Brazil: Acre, Amazonas, Pará, Rio Grande do Sul, Santa Catarina, Paraná, Amazonas (Lugo-Ortiz and McCafferty 1998). **New Records**: Bahia, Maranhão	P3 (10N) - INPA; P19 (Ep-2243 – 2N); P20 (Ep-2244 – 1N); P22 (Ep-2245 – 1N); P27 (Ep-2246 – 4N) - CEUNES
Cryptonympha dasilvai **Salles and Francischetti**	Brazil: Rio de Janeiro, São Paulo (Salles and Francischetti 2004); Espírito Santo (Salles *et al.* 2010a), Bahia (Lima *et al.* 2010)	P19 (1N) - INPA
Guajirolus rondoni **Salles**	Brazil: Rondônia (Salles 2007). **New Record**: Maranhão	P1 (3N) - INPA
Harpagobaetis gulosus **Mol**	Venezuela (Nieto *et al.* 2011); Suriname (Mol 1986); Brazil: Goiás (Salles and Lugo-Ortiz 2002b); Mato Grosso (Salles *et al.* 2004b), Roraima (Falcão *et al.* 2010). **New Record**: Maranhão	P1 (3N) - INPA
Paracloeodes eurybranchus **Lugo-Ortiz and McCafferty**	Argentina, Brazil: Rio Grande do Sul (Lugo-Ortiz and McCafferty 1996c); Espírito Santo (Lugo-Ortiz *et al.* 2002); São Paulo (Salles *et al.* 2003); Rio de Janeiro, Minas Gerais (Salles *et al.* 2004a). **New Record**: Maranhão	P2 (3N); P22 (2N) - INPA
Paracloeodes binodulus **Lugo-Ortiz and McCafferty** (Figure 11)	Brazil: Pará (Lugo-Ortiz and McCafferty 1996c); Mato Grosso (Salles *et al.* 2004b); Amazonas (Nieto and Salles 2006). **New Record**: Maranhão	P2 (3N) - INPA
Paracloeodes pacawara **Nieto and Salles**	Bolivia (Nieto and Salles 2006). **New Records**: Brazil: Piauí, Bahia	P5 (1N); P8 (2N) - INPA
Paracloeodes quadridentatus **Lima and Salles**	Brazil: Bahia (Lima *et al.* 2010)	
Paracloeodes waimiri **Nieto and Salles** (Figure 12)	Brazil: Amazonas (Nieto and Salles 2006). **New Records**: Maranhão, Piauí, Ceará, Bahia, Goiás	P4 (15N); P5 (1N); P6 (1N); P8 (2N); P10 (1N); P11 (7N); P12 (1N); P16 (4N); P18 (1M); P19 (1N); P16 (3N); P31 (4N) - INPA
Rivudiva trichobasis **Lugo-Ortiz and McCafferty** (Figure 13)	Brazil: Rio Grande do Sul, Amazonas (Lugo-Ortiz and McCafferty 1998). **New Record**: Maranhão	P2 (2N) - INPA
Spiritiops silvudus **Lugo-Ortiz and McCafferty** (Figure 14)	Venezuela (Nieto *et al.* 2011); French Guiana, Brazil: Amazonas, Pará (Lugo-Ortiz and McCafferty 1998); Mato Grosso (Salles *et al.* 2004b); Bahia (Lima *et al.* 2010). **New Records**: Maranhão, Goiás	P2 (Ep-2247 – 15N) - CEUNES; P18 (8N); P20 (4N); P21 (4N); P24 (2N) - INPA
Waltzoyphius fasciatus **McCafferty and Lugo-Ortiz** (Figure 15)	Paraguay, Brazil: Amazonas, Pará (Lugo-Ortiz and McCafferty 1995); Espírito Santo (Lugo-Ortiz *et al.* 2002); São Paulo (Salles *et al.* 2003); Minas Gerais, Rio de Janeiro (Salles *et al.* 2004); Mato Grosso (Salles *et al.* 2004b); Bahia (Lima *et al.* 2010). **New Record**: Goiás	P12 (Ep-2248 – 1N); P16 (Ep-2249 – 1N); P21 (Ep-2250 – 1N); P22 (Ep-2251 – 1N); P24 (Ep-2252 – 1N); P25 (Ep-2253 – 1N) - CEUNES; P27 (3N) - INPA
Waltzoyphius roberti **Thomas and Peru**	French Guiana (Thomas and Peru 2002); Brazil: Mato Grosso (Shimano *et al.* 2010). **New Record**: Bahia	P10 (4N) - INPA
Zelusia principalis **Lugo-Ortiz and McCafferty**	Venezuela (Nieto *et al.* 2011); Colombia, Brazil: Amazonas, Pará (Lugo-Ortiz and McCafferty 1998); São Paulo (Salles *et al.* 2003); Minas Gerais, Rio de Janeiro (Salles *et al.* 2004a); Mato Grosso (Salles *et al.* 2004b); Bahia (Lima *et al.* 2010)	

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